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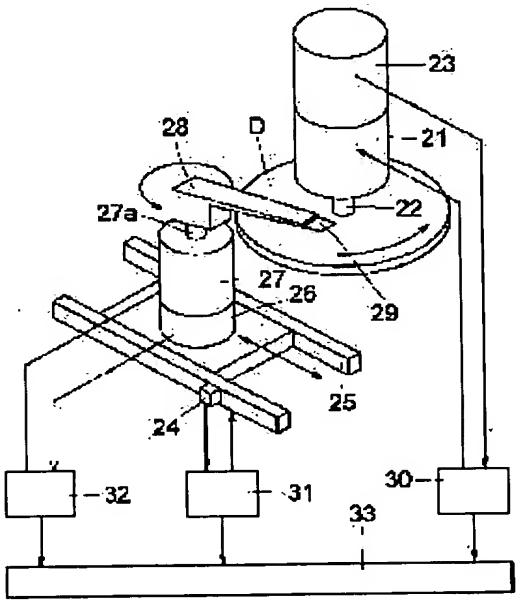
(54) INSPECTION DEVICE AND DRIVER

(57)Abstract:
PROBLEM TO BE SOLVED: To make a skew angle coincide with an actual magnetic storage device in a short time.
SOLUTION: A disk D is supported by a spindle motor 21 and a rotary speed detecting means 23 is mounted on the motor 21. A linear positioning mechanism 25, which has a linear position detecting means 24, is arranged in the vicinity of the disk D and a rotational positioning motor 27 is mounted on the mechanism 25 through a rotational angle detecting means 26. The motor 27 supports the base section of an arm 28 and a head 29 is mounted on a tip of the arm 28. The distance between the center of rotation of the disk D and the center of rotation of the arm 28 is made coincide with a hard disk drive by the mechanism 25. Then, the arm 28 is rotatively driven by the motor 27 so that the skew angle at the radial direction distance of the head 29 is made coincide with the hard disk drive.



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* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1] Test equipment which is equipped with the following and characterized by constituting so that the angle of the aforementioned record to each aforementioned truck at the time of carrying out alignment of the head for the aforementioned record and/or reproduction to each truck on the aforementioned record disk which rotates by positioning of this relative-position arrangement mechanism one by one, and/or the head for reproduction may be in agreement with the angle in the aforementioned drive equipment. The disk rolling mechanism for being equipment for at least one side of whether to carry out inspection of the aforementioned record disk used for whether inspection of the head for record and/or reproduction used for the drive equipment which performs informational record and/or informational reproduction on a record disk using the record on a revolving arm and/or the reproducing head conducts using the record disk used as criteria, and the aforementioned drive equipment using the head for record and/or reproduction become with criteria, and rotating the aforementioned record disk. The arm positioning mechanism which carries out rotation positioning of the aforementioned revolving arm. The relative-position arrangement mechanism for carrying out the relative-position arrangement of the aforementioned revolving arm and the aforementioned disk rolling mechanism.
[Claim 2] The aforementioned relative-position arrangement mechanism is test equipment according to claim 1 characterized by making the interval of the center of rotation of the aforementioned disk rolling mechanism, and the center of rotation of the aforementioned arm positioning mechanism in agreement with the interval in the aforementioned drive equipment.
[Claim 3] The size of the aforementioned revolving arm and the size of the aforementioned record disk are test equipment according to claim 2 characterized by setting up so that equally to the size in the aforementioned drive equipment.
[Claim 4] The angle of the aforementioned arm to the line which connects the center of rotation of the aforementioned disk rolling mechanism, and the center of rotation of the aforementioned arm positioning mechanism theta, The distance of the aforementioned record to the center of rotation of the aforementioned disk rolling mechanism, and/or the head for reproduction r, Test equipment according to claim 3 characterized by realizing the next relation when the interval of the head for X, the aforementioned record, and/or reproduction and the center of rotation of the aforementioned arm positioning mechanism is set to L for the interval of the center of rotation of the aforementioned disk rolling mechanism, and the center of rotation of the aforementioned arm positioning mechanism.
Theta=arcsin {(r/X)+(X2-L2-r2)/2rX}-arcsin {(X2-L2-r2)/2rL}
[Claim 5] The aforementioned relative-position arrangement mechanism by giving angle of rotation of the aforementioned arm according the distance of the center of rotation of the aforementioned disk rolling mechanism, and the center of rotation of the aforementioned arm positioning mechanism to the aforementioned arm positioning mechanism, and a predetermined relation, and changing them Test equipment according to claim 4 characterized by making the angle of the aforementioned record to each truck and/or the head for reproduction at the time of carrying out alignment of the head for the aforementioned record and/or reproduction to each truck on the rotating aforementioned record disk one by one in agreement with the angle in the aforementioned drive equipment.
[Claim 6] The angle of the aforementioned arm to the line which connects the center of rotation of the aforementioned disk rolling mechanism, and the center of rotation of the aforementioned arm positioning mechanism theta, The distance of the aforementioned record to the center of rotation of the aforementioned disk rolling mechanism, and/or the head for reproduction r, When the interval of the head for X, the aforementioned record, and/or reproduction and the center of rotation of the aforementioned arm positioning mechanism is set to L for the interval of the center of rotation of the aforementioned disk rolling mechanism, and the center of rotation of the aforementioned arm positioning mechanism, Test equipment according to claim 5 characterized by facing carrying out alignment of the head for the aforementioned record and/or reproduction to each aforementioned truck one by one, and performing positioning operation of the aforementioned arm positioning mechanism and the aforementioned relative-position arrangement mechanism so that the next relation may be realized.
X -- =(L2+r2+2rL-sinalpha) 1 / 2 theta=arcsin {(r/X)+(L/X) sinalpha}-alpha-pi / 2<arcsin {(r/X)+(L/X) sinalpha} -- <pi/2 [Claim 7] The center of rotation of the aforementioned arm positioning mechanism is test equipment according to claim 6 characterized by being in a field perpendicular to the axis of rotation on the locus of straight-line movement of the center of rotation of the aforementioned disk rolling mechanism by straight-line movement of the aforementioned relative-position arrangement mechanism, or its extension wire.
[Claim 8] The center of rotation of the aforementioned arm positioning mechanism is test equipment according to claim 6 characterized by having separated in a field perpendicular to the axis of rotation from the locus of the center of rotation of the aforementioned disk rolling mechanism by straight-line movement of the aforementioned relative-position arrangement mechanism, or its extension wire.
[Claim 9] [in a field perpendicular to the aforementioned axis of rotation] the aforementioned locus, the locus of the perpendicular to the extension wire, or the distance of an intersection with the extension wire, and the center of rotation of the aforementioned arm positioning mechanism from the center of rotation of the aforementioned disk rolling mechanism b, Test equipment according to claim 8 characterized by realizing the next relation when the aforementioned locus of A and the aforementioned revolving arm or an angle with the extension wire is set to phi for the length of the perpendicular from the center of rotation of the aforementioned disk rolling mechanism to the aforementioned locus or its extension wire.
b=(X2-A2) 1 / 2 phi=theta+arcsin (X/A)
[Claim 10] [whether inspection of the head for record and/or reproduction used for the drive equipment which performs

informational record and/or informational reproduction on a record disk using the record on a revolving arm and/or the reproducing head is conducted using the record disk used as criteria, and] It is a method for at least one side of whether to conduct inspection of the record disk used as the criteria used for the aforementioned drive equipment using the head for record and/or reproduction. Rotation of the aforementioned record disk, Rotation positioning of the aforementioned revolving arm and the relative-position arrangement with the aforementioned revolving arm and the center of the aforementioned disk rotation are performed. by this relative-position arrangement The inspection method that the angle of the aforementioned record to each aforementioned truck at the time of carrying out alignment of the head for the aforementioned record and/or reproduction to each truck on the rotating aforementioned record disk one by one and/or the head for reproduction is characterized by making it in agreement with the angle in the aforementioned drive equipment.

[Claim 11] The aforementioned relative-position arrangement is the inspection method according to claim 10 characterized by making the interval of the center of rotation of the aforementioned disk rotation, and the center of rotation of the aforementioned arm positioning in agreement with the interval in the aforementioned drive equipment.

[Claim 12] The size of the aforementioned revolving arm and the size of the aforementioned record disk are the inspection method according to claim 11 characterized by setting up so that equally to the size in the aforementioned drive equipment.

[Claim 13] The angle of the aforementioned arm to the line which connects the center of rotation of the aforementioned disk rotation, and the center of rotation of the aforementioned arm positioning theta, The distance of the aforementioned record to the center of rotation of the aforementioned disk rotation, and/or the head for reproduction r, The inspection method according to claim 12 characterized by realizing the next relation when the interval of the head for X, the aforementioned record, and/or reproduction and the center of rotation of the aforementioned arm positioning is set to L for the interval of the center of rotation of the aforementioned disk rotation, and the center of rotation of the aforementioned arm positioning.

Theta=arcsin {(r/X)+(X2-L2-r2)/2rX}-arcsin {(X2-L2-r2)/2rL}

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the test equipment and drive equipment which inspect the record disk of business, such as a hard disk drive which are magnetic storage, such as a computer, or record, and/or the reproducing head.
[0002]
[Description of the Prior Art] The positioning mechanism of this kind in the former of test equipment is indicated by JP,6-150269,A, and as shown in drawing 12 , the rotation drive of the magnetic disk 1 is carried out by the spindle motor 2. The rotation drive of the arm 4 equipped with the magnetic head 3 at the nose of cam is carried out by the ring-like rotation positioning mechanism 5 a center [a head 3]. And the rotation positioning mechanism 5 is linearly driven to radial [of a disk 1] according to the straight-line positioning mechanism 6.
[0003] Such a positioning mechanism is used in order to inspect a hard disk drive as shown in drawing 13 . In this hard disk drive, a rotation drive is carried out by the rotation positioning mechanism 15, and the arm 14 to which the rotation drive was carried out by the spindle motor 12, and the magnetic disk 11 was equipped with the magnetic head 13 at the nose of cam is positioned.
[0004] As shown in drawing 14 , angle-of-skew alpha which two or more magnetic tracks 11a and 11b and ... are formed in the disk 11 in the shape of a concentric circle, and magnetic tracks 11a and 11b, and the tangent and arm 14 of ... accomplish changes with positions of a head 13, for example, those of angle-of-skew alpha to outside truck 11a is larger than angle-of-skew alpha to inside truck 11b.
[0005] Therefore, as shown in drawing 15 , when the size of a disk 11 is 2.5 inches, angle-of-skew alpha to the radial distance r of the center of rotation of a disk 11 and a head 13 changes, as ultimate lines a show, and when the size of a disk 11 is 3.5 inches, as ultimate lines b show, it changes.
[0006] In case a disk 11 and a head 13 are inspected, angle-of-skew alpha of test equipment is made in agreement with angle-of-skew alpha of a hard disk drive, it reappears, and it is important to make test equipment and a hard disk drive into these conditions. In this case, whenever it makes one angle-of-skew alpha in agreement with angle-of-skew alpha of a hard disk drive, it is necessary to operate the both sides of the rotation positioning mechanism 5 and the straight-line positioning mechanism 6, to position a head 3, and to position the head 3 of test equipment to the total position of a disk 1 by repeating the same operation.
[0007]
[Problem(s) to be Solved by the Invention] However, in the above-mentioned conventional example, since it is necessary to position a head 3 by two operation, the rotation positioning mechanism 5 and the straight-line positioning mechanism 6, whenever it makes one angle-of-skew alpha in agreement with angle-of-skew alpha of a hard disk drive, there is a trouble that it is impossible to position a head 3 continuously to the total position of a disk 1, and much time is needed.
[0008] The purpose of this invention cancels an above-mentioned trouble, and is to offer the reliable drive equipment using the head or disk inspected by the test equipment of the head which may make an angle of skew in agreement with actual drive equipment for a short time, or a disk, and it.
[0009]
[Means for Solving the Problem] The test equipment concerning this invention for attaining the above-mentioned purpose [whether inspection of the head for record and/or reproduction used for the drive equipment which performs informational record and/or informational reproduction on a record disk using the record on a revolving arm and/or the reproducing head is conducted using the record disk used as criteria, and] The disk rolling mechanism for being equipment for at least one side of whether to conduct inspection of the aforementioned record disk used for the aforementioned drive equipment using the head for record and/or reproduction used as criteria, and rotating the aforementioned record disk, It has a relative-position arrangement mechanism for carrying out the relative-position arrangement of the arm positioning mechanism which carries out rotation positioning of the aforementioned revolving arm, and the aforementioned revolving arm and the aforementioned disk rolling mechanism. by positioning of this relative-position arrangement mechanism It is characterized by constituting so that the angle of the aforementioned record to each aforementioned truck at the time of carrying out alignment of the head for the aforementioned record and/or reproduction to each truck on the rotating aforementioned record disk one by one and/or the head for reproduction may be in agreement with the angle in the aforementioned drive equipment.
[0010] Moreover, the inspection method concerning this invention [whether inspection of the head for record and/or reproduction used for the drive equipment which performs informational record and/or informational reproduction on a record disk using the record on a revolving arm and/or the reproducing head is conducted using the record disk used as criteria, and] It is a method for at least one side of whether to conduct inspection of the record disk used as the criteria used for the aforementioned drive equipment using the head for record and/or reproduction. Rotation of the aforementioned record disk, Rotation positioning of the aforementioned revolving arm and the relative-position arrangement with the aforementioned revolving arm and the center of the aforementioned disk rotation are performed. by this relative-position arrangement The angle of the aforementioned record to each aforementioned truck at the time of carrying out alignment of the head for the aforementioned record and/or reproduction to each truck on the rotating aforementioned record disk one by one and/or the head for reproduction is characterized by making it in agreement with the angle in the aforementioned drive equipment.
[0011] The drive equipment concerning this invention is drive equipment which performs informational record and/or

informational reproduction on a record disk using the record on a revolving arm, and/or the reproducing head. The aforementioned record disk, It has a head for the aforementioned record and/or reproduction. the head for the aforementioned record and/or reproduction at the time of inspection ** Rotation of the aforementioned record disk, rotation positioning of the ** aforementioned revolving arm, the relative-position arrangement with the ** aforementioned revolving arm and the center of the aforementioned disk rotation, Inspection is conducted using the record disk which serves as criteria by ******. by the aforementioned relative-position arrangement The time of carrying out alignment of the head for the aforementioned record and/or reproduction to each truck on the rotating aforementioned record disk one by one, It is characterized by conducting inspection, as the angle of the aforementioned record to each aforementioned truck and/or the head for reproduction is in agreement with the angle in the aforementioned drive equipment.

[0012] The drive equipment concerning this invention is drive equipment which performs informational record and/or informational reproduction on a record disk using the record on a revolving arm, and/or the head for reproduction. The aforementioned record and/or the head for reproduction, It has the aforementioned record disk. the aforementioned record disk at the time of inspection Rotation of the ** aforementioned record disk, Inspection is conducted using the head for record and/or reproduction which serves as criteria according to the process of rotation positioning of the aforementioned revolving arm, and relative-position arrangement [with the ** aforementioned revolving arm and the center of the aforementioned disk rotation] **. ** By the aforementioned relative-position arrangement The time of carrying out alignment of the head for the aforementioned record and/or reproduction to each aforementioned truck on the rotating aforementioned record disk one by one, It is characterized by conducting inspection, as the angle of the aforementioned record to each truck and/or the head for reproduction is in agreement with the angle in the aforementioned drive equipment.

[0013]

[Embodiments of the Invention] this invention is explained to drawing 1 - drawing 11 in detail based on the example of illustration. Drawing 1 is the block diagram of the 1st example, and explains the case where it applies to the checking equipment of a head, by this example. The disk D for magnetic-recording reproduction is made into the criteria of head inspection, and is supported by the axis of rotation 22 of a spindle motor 21. The spindle motor 21 is supported by the case which is not illustrated and the rotational-speed detection means 23 is attached. The straight-line positioning mechanism 25 equipped with the straight-line position detection means 24 near the disk D is arranged, and this straight-line positioning mechanism 25 is supported by the case. The rotation positioning motor 27 is laid in the straight-line positioning mechanism 25 through the angle-of-rotation detection meanses 26, such as a rotary encoder. And the base of an arm 28 is supported by axis-of-rotation 27a of the rotation positioning motor 27, and the head 29 for magnetic-recording reproduction which is the subject of examination which carries out record reproduction of the magnetic signal to Disk D is attached at the nose of cam of this arm 28.

[0014] The R/W function of a head is inspected by connecting with the inspection circuit which is not illustrated in signal, and this head's writing an inspection signal in each truck on Disk D, and reading it. As a modification, only one side of record and reproduction is performed with this equipment, and another side is performed by another dedicated device, and may be made to perform inspection with both equipments. The subject of examination in this case (here head) may have only one function of record and reproduction.

[0015] A spindle motor 21 and the rotational-speed detection means 23 are connected to the spindle motor driver 30, the straight-line position detection means 24 and the straight-line positioning mechanism 25 are connected to the straight-line positioning controller 31, and the angle-of-rotation detection means 26 and the rotation positioning motor 27 are connected to the rotation positioning controller 32. And these driver 30 and controllers 31 and 32, and the inspection circuit which is not illustrated are connected to the main controller 33.

[0016] Drawing 2 is the ** type view showing the arm 28 on Disk D, and the physical relationship of a head 29. The positioner angle theta which is an angle of the arm 28 to the line which connects the center of rotation C1 of Disk D, and the center of rotation C2 of an arm 28 The radial distance r which is the distance of the head 29 to the center of rotation C1 of Disk D Between the arm length L which is the distance of the distance X between the centers of rotation, the center of rotation C2 of an arm 28, and the head 29 which are the distance of the center of rotation C1 of Disk D, and the center of rotation C2 of an arm 28 Theta=arcsin {(r/X)+(X2-L2-r2)/2rX} -arcsin {(X2-L2-r2)/2rL} -- The relational expression of (1) is materialized and the positioner angle theta can be computed now.

[0017] Such length L of the size of the disk D of the test equipment of composition or an arm 28 needs to be in agreement with the specification of the hard disk drive of business, such as a computer which should be inspected and which is not illustrated. And in case the magnetic head of a hard disk drive is inspected, the center of rotation C2 of an arm 28 is first moved linearly according to the straight-line positioning mechanism 25, and the distance X between the centers of rotation is made in agreement with the specification of the hard disk drive for which a head should actually be used. Next, formula (1) Based on the positioner angle theta which carried out shell calculation, the rotation drive of the arm 28 is carried out by the rotation positioning motor 27, and a head 29 is positioned. Thereby, angle-of-skew alpha of a head 29 can be made in agreement with it at the time of the use in an actual hard disk drive.

[0018] At this time, the straight-line positioning controller 31 outputs a driving signal to the straight-line positioning mechanism 25 based on the position signal from the straight-line position detection means 24 by instructions of the main controller 33, and the straight-line positioning mechanism 25 carries out a straight-line drive in the position of a request of the center of rotation C2 of an arm 28. Similarly, by instructions of the main controller 33, the rotation positioning controller 32 outputs an angle signal to the rotation positioning motor 27 based on the angle signal from the angle-of-rotation detection means 26, and only the angle of the rotation positioning motor's 27 a request of an arm 28 carries out a rotation drive.

[0019] Thus, since the rotation drive of the arm 28 is carried out based on the computed positioner angle theta and a head 29 is positioned after making the distance X between the centers of rotation in agreement with a hard disk drive, the locus of a head 29 can be completely made in agreement with a hard disk drive in the 1st example. Therefore, to all the positions of Disk D, a head 29 can be positioned in a short time, and angle-of-skew alpha of a head 29 can be continuously made continuously in agreement [a head] with a hard disk drive for a short time.

[0020] For this composition, the disk D created in the size corresponding to the specification of each hard disk drive and the arm 28 are prepared, and the head to test takes and it consists of these equipment possible [exchange] suitably according to the specification of a ******** hard disk drive.

[0021] Drawing 3 shows the arm 28 on the disk D in the 2nd example, and the physical relationship of a head 29. With this equipment, the center of rotation C1 of Disk D is arranged within the plan on the orbit of the arm center of rotation C2 by movement of the straight-line positioning mechanism 25. Since appearance composition is the same as that of drawing 2 ,

explanation is omitted. In this 2nd example, each following formula is materialized as - pi<alpha<pi.
[0022]
X=(L2+r2+2 rL-sin alpha)} 1/2 — (2) Theta=arcsin {(r/X)+(L/X) sinalpha}-alpha — (3) -pi / 2<arcsin {(r/X)+(L/X) sinalpha} <pi/2 — (4) [0023] Drawing 4 is the flow chart view showing the step as which the main controller 33 determines angle-of-skew alpha, and reads the arm length L, the radial distance r, and angle-of-skew alpha from the external input equipment 34 by operation of an operator, a register, or external storage 35 in Step S1 first. Next, it sets to Step S2 and is a formula (2). - (4) The distance X between the shell centers of rotation and the positioner angle theta are computed. And in Step S3, the computed distance X between the centers of rotation is outputted to the straight-line positioning mechanism 25, and the center of rotation C2 of an arm 28 is positioned. Finally in Step S4, the computed positioner angle theta is outputted to the rotation positioning motor 27, and the positioner angle theta of an arm 28 is positioned.
[0024] Drawing 5 is a formula (2). - formula (4) It is based, the change of the distance X between the centers of rotation to computed angle-of-skew alpha is shown, and drawing 6 is a formula (2). - (4) It is based, the change of the positioner angle theta to computed angle-of-skew alpha is shown, and radial distance r is aimed at the truck in 15mm and 25mm for all. Moreover, drawing 7 is a formula (2). - (4) The check of tracing of the head 29 at the time of being based and changing angle-of-skew alpha of the positioned head 29 is shown, and the head 29 is changing angle-of-skew alpha, moving the same truck top.
[0025] In this 2nd example, a head 29 can be positioned based on the distance X between the centers of rotation and the positioner angle theta which were computed, angle-of-skew alpha in the radial distance r can be set up arbitrarily, and the same effect as the 1st example can be attained. According to this example, head inspection can be performed by the same angle of skew as the time of actual use to the head for the hard disk drives of arbitrary specifications, without exchanging an arm and a disk.
[0026] Drawing 8 is drawing showing the physical relationship of the disk D of the 3rd operation, an arm 28, and a head 29, and the center of rotation C1 of Disk D is removed within the plan from the orbit 36 of the arm center of rotation C2 by movement of the straight-line positioning mechanism 25, or its extension wire. Here the distance X between the centers of rotation, and the positioner angle theta Above-mentioned formula (2) - (4) Distance b of the point that are based, and the perpendicular from the center of rotation C1 of Disk D crosses an orbit 36 since it can determine, and the center of rotation C2 of an arm 28 The angle phi to the distance A of the perpendicular from the center of rotation C1 of Disk D to an orbit 36, and the orbit 36 of an arm 28 b=(X2-A2) 1/2 -- (5) Phi=theta+arcsin (X/A) — Each formula of (6) is materialized and Distance b and an angle phi can be computed.
[0027] Drawing 9 is a formula (5). (6) It is based, the change of the distance X between the centers of rotation to computed angle-of-skew alpha is shown, and drawing 10 is a formula (5). (6) It is based, the change of the positioner angle theta to computed angle-of-skew alpha is shown, and radial distance r is aimed at the truck in 15mm and 25mm for all. And drawing 11 is a formula (5). (6) The check of tracing of the head 29 at the time of being based and changing angle-of-skew alpha of the positioned head 29 is shown, and angle-of-skew alpha is changed, moving a head 29 on the same truck.
[0028] At this 3rd example, it is a formula (5). The distance b based and determined corresponds to the position of the straight-line positioning mechanism 25, and is a formula (6). Since it is based and the computed angle phi corresponds to the rotation position of an arm 28 By determining the position of the straight-line positioning mechanism 25, and angle of rotation of a head 29, angle-of-skew alpha in the radial distance r of a head 29 can be set up arbitrarily, and the same effect as the 2nd example can be attained.
[0029] Although considered as the equipment which inspects a head on the basis of a disk in each example which more than explained, this head is used as a criteria head and it becomes an inspection disk, then disk test equipment about a disk side. Also in this case, it will be understood easily that this invention is suitable. Furthermore, you may inspect both separately with one equipment.
[0030] Moreover, good equipment is obtained by building into hard disk drive equipment the head or disk inspected by doing in this way, as shown in drawing 1 .
[0031]
[Effect of the Invention] Like the 1st example explained above, after making the size of an arm or a disk, and the distance between the centers of rotation in agreement with actual magnetic storage by the straight-line positioning means Since an angle of skew is made in agreement with magnetic storage in the total position of a magnetic disk Two operations to the required rotation positioning means and a straight-line positioning means can become unnecessary to one angle of skew like before, and the angle of skew in the total position of a magnetic disk can be continuously made in agreement with actual magnetic storage for a short time. Moreover, if the technique of the 2nd and the 3rd example is used even if it does not make the size of an arm or a disk in agreement with practice, it can inspect similarly by the same angle of skew as the time of actual use.

[Translation done.]

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TECHNICAL FIELD

[The technical field to which invention belongs] this invention relates to the test equipment and drive equipment which inspect the record disk of business, such as a hard disk drive which are magnetic storage, such as a computer, or record, and/or the reproducing head.

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PRIOR ART

[Description of the Prior Art] The positioning mechanism of this kind in the former of test equipment is indicated by JP,6-150269,A, and as shown in drawing 12 , the rotation drive of the magnetic disk 1 is carried out by the spindle motor 2. The rotation drive of the arm 4 equipped with the magnetic head 3 at the nose of cam is carried out by the ring-like rotation positioning mechanism 5 a center [a head 3]. And the rotation positioning mechanism 5 is linearly driven to radial [of a disk 1] according to the straight-line positioning mechanism 6.
[0003] Such a positioning mechanism is used in order to inspect a hard disk drive as shown in drawing 13 . In this hard disk drive, a rotation drive is carried out by the rotation positioning mechanism 15, and the arm 14 to which the rotation drive was carried out by the spindle motor 12, and the magnetic disk 11 was equipped with the magnetic head 13 at the nose of cam is positioned.
[0004] As shown in drawing 14 , angle-of-skew alpha which two or more magnetic tracks 11a and 11b and ... are formed in the disk 11 in the shape of a concentric circle, and magnetic tracks 11a and 11b, and the tangent and arm 14 of ... accomplish changes with positions of a head 13, for example, those of angle-of-skew alpha to outside truck 11a is larger than angle-of-skew alpha to inside truck 11b.
[0005] Therefore, as shown in drawing 15 , when the size of a disk 11 is 2.5 inches, angle-of-skew alpha to the radial distance r of the center of rotation of a disk 11 and a head 13 changes, as ultimate lines a show, and when the size of a disk 11 is 3.5 inches, as ultimate lines b show, it changes.
[0006] In case a disk 11 and a head 13 are inspected, angle-of-skew alpha of test equipment is made in agreement with angle-of-skew alpha of a hard disk drive, it reappears, and it is important to make test equipment and a hard disk drive into these conditions. In this case, whenever it makes one angle-of-skew alpha in agreement with angle-of-skew alpha of a hard disk drive, it is necessary to operate the both sides of the rotation positioning mechanism 5 and the straight-line positioning mechanism 6, to position a head 3, and to position the head 3 of test equipment to the total position of a disk 1 by repeating the same operation.

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EFFECT OF THE INVENTION

[Effect of the Invention] After making the size of an arm or a disk, and the distance between the centers of rotation in agreement with actual magnetic storage by the straight-line positioning means like the 1st example explained above, Since an angle of skew is made in agreement with magnetic storage in the total position of a magnetic disk, two operations to the required rotation positioning means and a straight-line positioning means can become unnecessary to one angle of skew like before, and the angle of skew in the total position of a magnetic disk can be continuously made in agreement with actual magnetic storage for a short time. Moreover, if the technique of the 2nd and the 3rd example is used even if it does not make the size of an arm or a disk in agreement with practice, it can inspect similarly by the same angle of skew as the time of actual use.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, in the above-mentioned conventional example, since it is necessary to position a head 3 by two operation, the rotation positioning mechanism 5 and the straight-line positioning mechanism 6, whenever it makes one angle-of-skew alpha in agreement with angle-of-skew alpha of a hard disk drive, there is a trouble that it is impossible to position a head 3 continuously to the total position of a disk 1, and much time is needed.
[0008] The purpose of this invention cancels an above-mentioned trouble, and is to offer the reliable drive equipment using the head or disk inspected by the test equipment of the head which may make an angle of skew in agreement with actual drive equipment for a short time, or a disk, and it.

[Translation done.]

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MEANS

[Means for Solving the Problem] The test equipment concerning this invention for attaining the above-mentioned purpose [whether inspection of the head for record and/or reproduction used for the drive equipment which performs informational record and/or informational reproduction on a record disk using the record on a revolving arm and/or the reproducing head is conducted using the record disk used as criteria, and] The disk rolling mechanism for being equipment for at least one side of whether to conduct inspection of the aforementioned record disk used for the aforementioned drive equipment using the head for record and/or reproduction used as criteria, and rotating the aforementioned record disk, It has a relative-position arrangement mechanism for carrying out the relative-position arrangement of the arm positioning mechanism which carries out rotation positioning of the aforementioned revolving arm, and the aforementioned revolving arm and the aforementioned disk rolling mechanism. by positioning of this relative-position arrangement mechanism It is characterized by constituting so that the angle of the aforementioned record to each aforementioned truck at the time of carrying out alignment of the head for the aforementioned record and/or reproduction to each truck on the rotating aforementioned record disk one by one and/or the head for reproduction may be in agreement with the angle in the aforementioned drive equipment.
[0010] Moreover, the inspection method concerning this invention [whether inspection of the head for record and/or reproduction used for the drive equipment which performs informational record and/or informational reproduction on a record disk using the record on a revolving arm and/or the reproducing head is conducted using the record disk used as criteria, and] It is a method for at least one side of whether to conduct inspection of the record disk used as the criteria used for the aforementioned drive equipment using the head for record and/or reproduction. Rotation of the aforementioned record disk, Rotation positioning of the aforementioned revolving arm and the relative-position arrangement with the aforementioned revolving arm and the center of the aforementioned disk rotation are performed. by this relative-position arrangement The angle of the aforementioned record to each aforementioned truck at the time of carrying out alignment of the head for the aforementioned record and/or reproduction to each truck on the rotating aforementioned record disk one by one and/or the head for reproduction is characterized by making it in agreement with the angle in the aforementioned drive equipment.
[0011] The drive equipment concerning this invention is drive equipment which performs informational record and/or informational reproduction on a record disk using the record on a revolving arm, and/or the reproducing head. The aforementioned record disk, It has a head for the aforementioned record and/or reproduction. the head for the aforementioned record and/or reproduction at the time of inspection ** Rotation of the aforementioned record disk, rotation positioning of the ** aforementioned revolving arm, the relative-position arrangement with the ** aforementioned revolving arm and the center of the aforementioned disk rotation, Inspection is conducted using the record disk which serves as criteria by ******. by the aforementioned relative-position arrangement The time of carrying out alignment of the head for the aforementioned record and/or reproduction to each truck on the rotating aforementioned record disk one by one, It is characterized by conducting inspection, as the angle of the aforementioned record to each aforementioned truck and/or the head for reproduction is in agreement with the angle in the aforementioned drive equipment.
[0012] The drive equipment concerning this invention is drive equipment which performs informational record and/or informational reproduction on a record disk using the record on a revolving arm, and/or the head for reproduction. The aforementioned record and/or the head for reproduction, It has the aforementioned record disk. the aforementioned record disk at the time of inspection Rotation of the ** aforementioned record disk, Inspection is conducted using the head for record and/or reproduction which serves as criteria according to the process of rotation positioning of the aforementioned revolving arm, and relative-position arrangement [with the ** aforementioned revolving arm and the center of the aforementioned disk rotation] **. ** By the aforementioned relative-position arrangement The time of carrying out alignment of the head for the aforementioned record and/or reproduction to each aforementioned truck on the rotating aforementioned record disk one by one, It is characterized by conducting inspection, as the angle of the aforementioned record to each truck and/or the head for reproduction is in agreement with the angle in the aforementioned drive equipment.
[0013]
[Embodiments of the Invention] this invention is explained to drawing 1 - drawing 11 in detail based on the example of illustration. Drawing 1 is the block diagram of the 1st example, and explains the case where it applies to the checking equipment of a head, by this example. The disk D for magnetic-recording reproduction is made into the criteria of head inspection, and is supported by the axis of rotation 22 of a spindle motor 21. The spindle motor 21 is supported by the case which is not illustrated and the rotational-speed detection means 23 is attached. The straight-line positioning mechanism 25 equipped with the straight-line position detection means 24 near the disk D is arranged, and this straight-line positioning mechanism 25 is supported by the case. The rotation positioning motor 27 is laid in the straight-line positioning mechanism 25 through the angle-of-rotation detection meanses 26, such as a rotary encoder. And the base of an arm 28 is supported by axis-of-rotation 27a of the rotation positioning motor 27, and the head 29 for magnetic-recording reproduction which is the subject of examination which carries out record reproduction of the magnetic signal to Disk D is attached at the nose of cam of this arm 28.
[0014] The R/W function of a head is inspected by connecting with the inspection circuit which is not illustrated in signal, and this head's writing an inspection signal in each truck on Disk D, and reading it. As a modification, only one side of record and reproduction is performed with this equipment, and another side is performed by another dedicated device, and may be made to perform inspection with both equipments. The subject of examination in this case (here head) may have only one function of record and reproduction.
[0015] A spindle motor 21 and the rotational-speed detection means 23 are connected to the spindle motor driver 30, the

straight-line position detection means 24 and the straight-line positioning mechanism 25 are connected to the straight-line positioning controller 31, and the angle-of-rotation detection means 26 and the rotation positioning motor 27 are connected to the rotation positioning controller 32. And these driver 30 and controllers 31 and 32, and the inspection circuit which is not illustrated are connected to the main controller 33.

[0016] Drawing 2 is the ** type view showing the arm 28 on Disk D, and the physical relationship of a head 29. The positioner angle theta which is an angle of the arm 28 to the line which connects the center of rotation C1 of Disk D, and the center of rotation C2 of an arm 28 The radial distance r which is the distance of the head 29 to the center of rotation C1 of Disk D Between the arm length L which is the distance of the distance X between the centers of rotation, the center of rotation C2 of an arm 28, and the head 29 which are the distance of the center of rotation C1 of Disk D, and the center of rotation C2 of an arm 28 Theta=arcsin {(r/X)+(X2-L2-r2)/2rX} -arcsin {(X2-L2-r2)/2rL} -- The relational expression of (1) is materialized and the positioner angle theta can be computed now.

[0017] Such length L of the size of the disk D of the test equipment of composition or an arm 28 needs to be in agreement with the specification of the hard disk drive of business, such as a computer which should be inspected and which is not illustrated. And in case the magnetic head of a hard disk drive is inspected, the center of rotation C2 of an arm 28 is first moved linearly according to the straight-line positioning mechanism 25, and the distance X between the centers of rotation is made in agreement with the specification of the hard disk drive for which a head should actually be used. Next, formula (1) Based on the positioner angle theta which carried out shell calculation, the rotation drive of the arm 28 is carried out by the rotation positioning motor 27, and a head 29 is positioned. Thereby, angle-of-skew alpha of a head 29 can be made in agreement with it at the time of the use in an actual hard disk drive.

[0018] At this time, the straight-line positioning controller 31 outputs a driving signal to the straight-line positioning mechanism 25 based on the position signal from the straight-line position detection means 24 by instructions of the main controller 33, and the straight-line positioning mechanism 25 carries out a straight-line drive in the position of a request of the center of rotation C2 of an arm 28. Similarly, by instructions of the main controller 33, the rotation positioning controller 32 outputs an angle signal to the rotation positioning motor 27 based on the angle signal from the angle-of-rotation detection means 26, and only the angle of the rotation positioning motor's 27 a request of an arm 28 carries out a rotation drive.

[0019] Thus, since the rotation drive of the arm 28 is carried out based on the computed positioner angle theta and a head 29 is positioned after making the distance X between the centers of rotation in agreement with a hard disk drive, tracing of a head 29 can be completely made in agreement with a hard disk drive in the 1st example. Therefore, to all the positions of Disk D, a head 29 can be positioned in a short time, and angle-of-skew alpha of a head 29 can be continuously made continuously in agreement [a head] with a hard disk drive for a short time.

[0020] For this composition, the disk D created in the size corresponding to the specification of each hard disk drive and the arm 28 are prepared, and the head to test takes and it consists of these equipment possible [exchange] suitably according to the specification of a ******** hard disk drive.

[0021] Drawing 3 shows the arm 28 on the disk D in the 2nd example, and the physical relationship of a head 29. With this equipment, the center of rotation C1 of Disk D is arranged within the plan on the orbit of the arm center of rotation C2 by movement of the straight-line positioning mechanism 25. Since appearance composition is the same as that of drawing 2 , explanation is omitted. In this 2nd example, each following formula is materialized as - pi<alpha<pi.

[0022]

X=(L2+r2+2 rL-sin alpha)] 1/2 -- (2) Theta=arcsin {(r/X)+(L/X) sinalpha}-alpha -- (3) -pi / 2<arcsin {(r/X)+(L/X) sinalpha} <pi/2 -- (4) [0023] Drawing 4 is the flow chart view showing the step as which the main controller 33 determines angle-of-skew alpha, and reads the arm length L, the radial distance r, and angle-of-skew alpha from the external input equipment 34 by operation of an operator, a register, or external storage 35 in Step S1 first. Next, it sets to Step S2 and is a formula (2). - (4) The distance X between the shell centers of rotation and the positioner angle theta are computed. And in Step S3, the computed distance X between the centers of rotation is outputted to the straight-line positioning mechanism 25, and the center of rotation C2 of an arm 28 is positioned. Finally in step S4, the computed positioner angle theta is outputted to the rotation positioning motor 27, and the positioner angle theta of an arm 28 is positioned.

[0024] Drawing 5 is a formula (2). - formula (4) It is based, the change of the distance X between the centers of rotation to computed angle-of-skew alpha is shown, and drawing 6 is a formula (2). - (4) It is based, the change of the positioner angle theta to computed angle-of-skew alpha is shown, and radial distance r is aimed at the truck in 15mm and 25mm for all. Moreover, drawing 7 is a formula (2). - (4) The check of tracing of the head 29 at the time of being based and changing angle-of-skew alpha of the positioned head 29 is shown, and the head 29 is changing angle-of-skew alpha, moving the same truck top.

[0025] In this 2nd example, a head 29 can be positioned based on the distance X between the centers of rotation and the positioner angle theta which were computed, angle-of-skew alpha in the radial distance r can be set up arbitrarily, and the same effect as the 1st example can be attained. According to this example, head inspection can be performed by the same angle of skew as the time of actual use to the head for the hard disk drives of arbitrary specifications, without exchanging an arm and a disk.

[0026] Drawing 8 is drawing showing the physical relationship of the disk D of the 3rd operation, an arm 28, and a head 29, and the center of rotation C1 of Disk D is removed within the plan from the orbit 36 of the arm center of rotation C2 by movement of the straight-line positioning mechanism 25, or its extension wire. Here the distance X between the centers of rotation, and the positioner angle theta Above-mentioned formula (2) - (4) Distance b of the point that are based, and the perpendicular from the center of rotation C1 of Disk D crosses an orbit 36 since it can determine, and the center of rotation C2 of an arm 28 The angle phi to the distance A of the perpendicular from the center of rotation C1 of Disk D to an orbit 36, and the orbit 36 of an arm 28 b=(X2-A2) 1/2 -- (5) Phi=theta+arcsin (X/A) -- Each formula of (6) is materialized and Distance b and an angle phi can be computed.

[0027] Drawing 9 is a formula (5). (6) It is based, the change of the distance X between the centers of rotation to computed angle-of-skew alpha is shown, and drawing 10 is a formula (5). (6) It is based, the change of the positioner angle theta to computed angle-of-skew alpha is shown, and radial distance r is aimed at the truck in 15mm and 25mm for all. And drawing 11 is a formula (5). (6) The check of tracing of the head 29 at the time of being based and changing angle-of-skew alpha of the positioned head 29 is shown, and angle-of-skew alpha is changed, moving a head 29 on the same truck.

[0028] At this 3rd example, it is a formula (5). The distance b based and determined corresponds to the position of the straight-line positioning mechanism 25, and is a formula (6). Since it is based and the computed angle phi corresponds to the rotation position of an arm 28 By determining the position of the straight-line positioning mechanism 25, and angle of rotation of a head

29, angle-of-skew alpha in the radial distance r of a head 29 can be set up arbitrarily, and the same effect as the 2nd example can be attained.
[0029] Although considered as the equipment which inspects a head on the basis of a disk in each example which more than explained, this head is used as a criteria head and it becomes an inspection disk, then disk test equipment about a disk side. Also in this case, it will be understood easily that this invention is suitable. Furthermore, you may inspect both separately with one equipment.
[0030] Moreover, good equipment is obtained by building into hard disk drive equipment the head or disk inspected by doing in this way, as shown in drawing 1 .

[Translation done.]

* NOTICES *

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3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram of the 1st example.
[Drawing 2] It is explanatory drawing of the physical relationship on the disk of a head and an arm.
[Drawing 3] They are the head of the 2nd example, and explanatory drawing of the physical relationship on the disk of an arm.
[Drawing 4] It is the flow chart view of the step which determines an angle of skew.
[Drawing 5] It is the graphical representation of the distance between the centers of rotation to an angle of skew.
[Drawing 6] It is the graphical representation of a positioner angle to an angle of skew.
[Drawing 7] It is the graphical representation of a check of tracing of a head to an angle of skew.
[Drawing 8] They are the head of the 3rd example, and explanatory drawing of the physical relationship on the disk of an arm.
[Drawing 9] It is the graphical representation of the distance between the centers of rotation to an angle of skew.
[Drawing 10] It is the graphical representation of a positioner angle to an angle of skew.
[Drawing 11] It is the graphical representation of a check of tracing of a head to an angle of skew.
[Drawing 12] It is the plan of the conventional example.
[Drawing 13] It is the perspective diagram of the hard disk drive of the conventional example.
[Drawing 14] They are the head of the conventional example, and explanatory drawing of the physical relationship on the disk of an arm.
[Drawing 15] It is explanatory drawing of the angle of skew to the radial distance of the conventional example.
[Description of Notations]
21 Spindle Motor
23 Rotational-Speed Detection Means
24 Straight-Line Position Detection Means
25 Straight-Line Positioning Mechanism
26 Angle-of-Rotation Detection Means
27 Rotation Positioning Motor
28 Arm
29 Head
D Disk
alpha Angle of skew
theta Positioner angle
r Radial distance
X Distance between the centers of rotation
L Arm length

[Translation done.]

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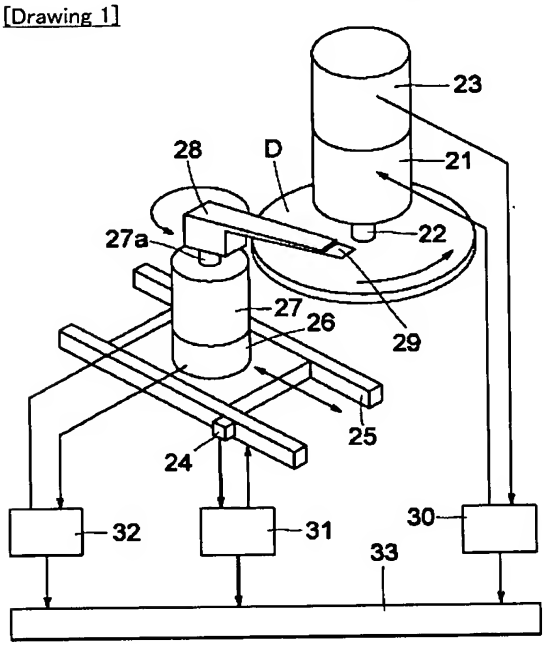
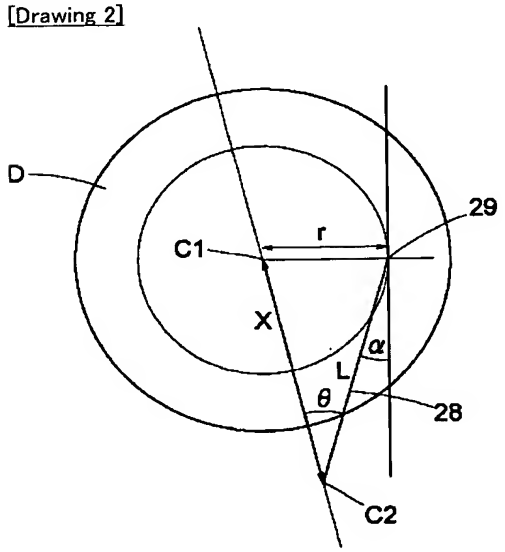
DRAWINGS

[Drawing 1]



[Drawing 2]



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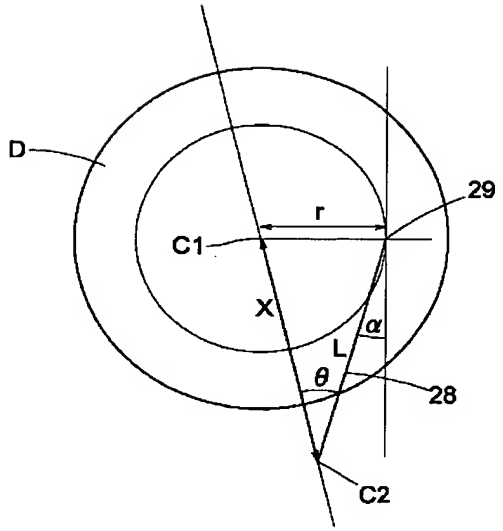

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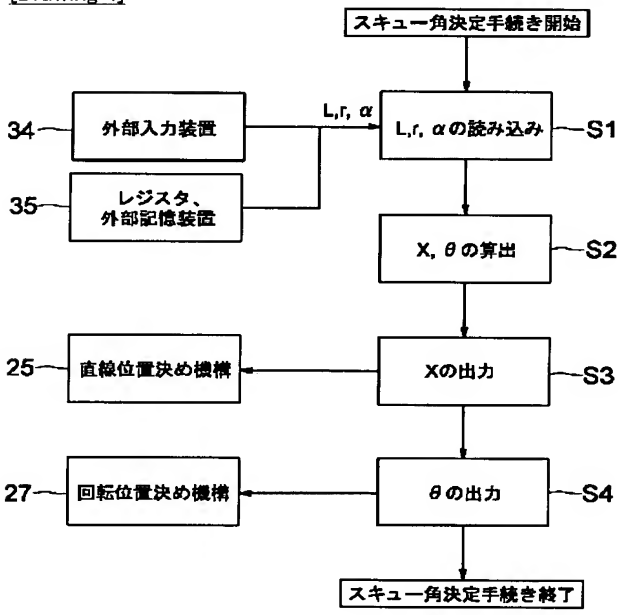

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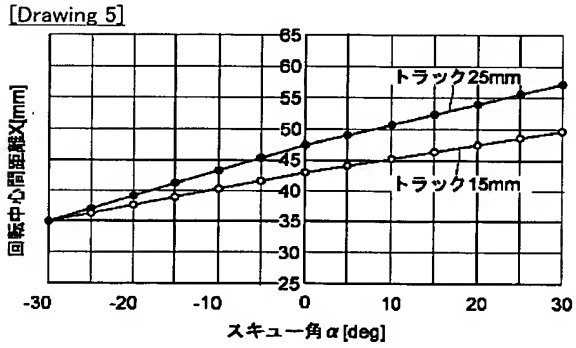
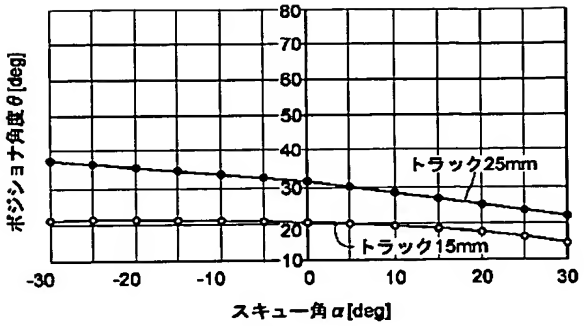


[Drawing 6]



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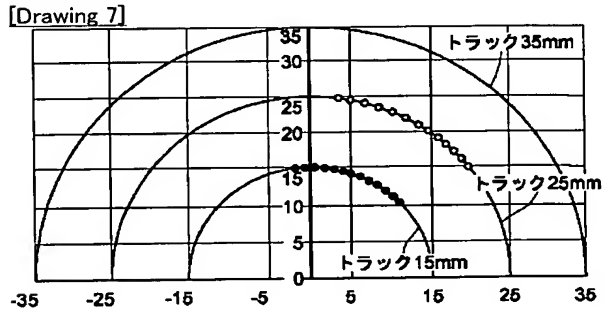

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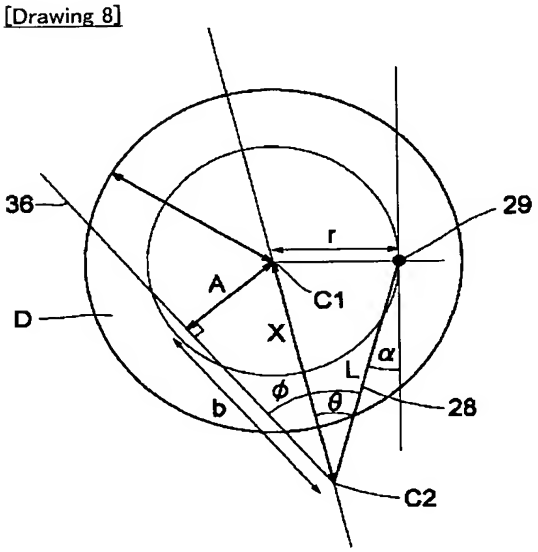

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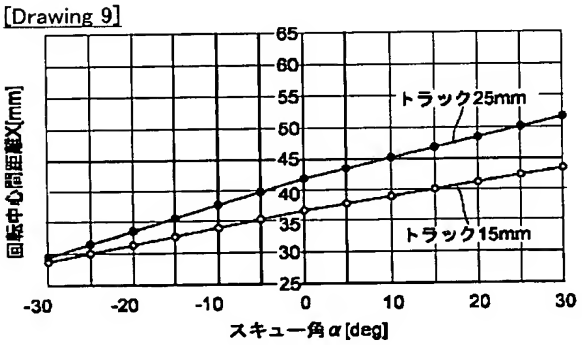
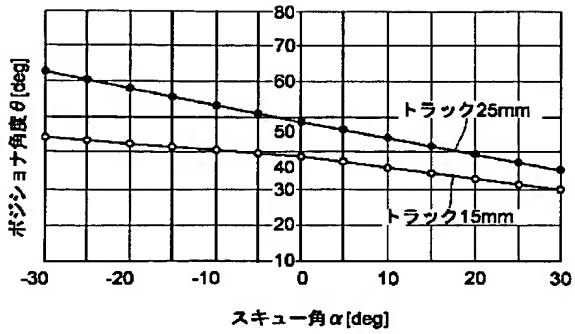
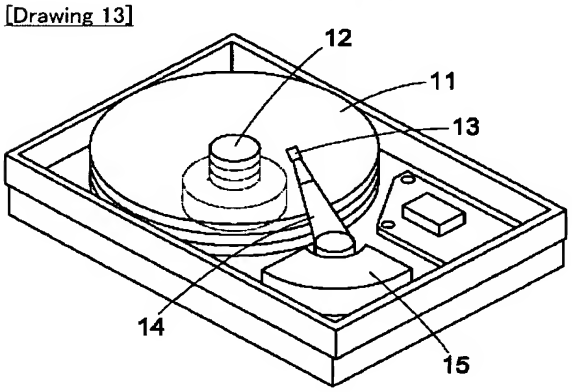


[Drawing 10]



[Drawing 13]



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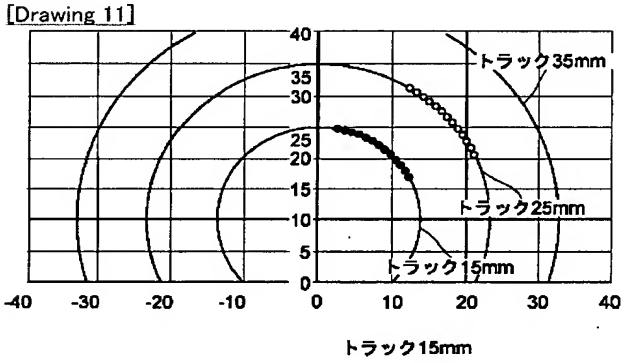

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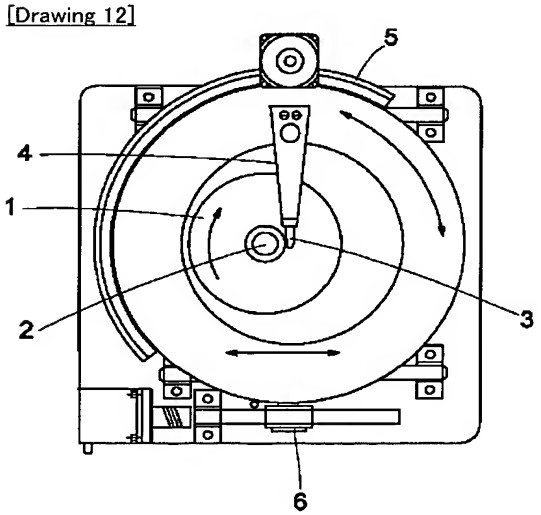
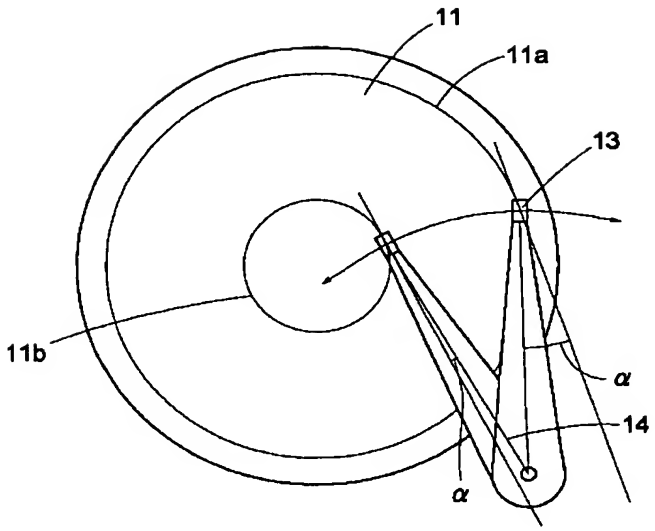
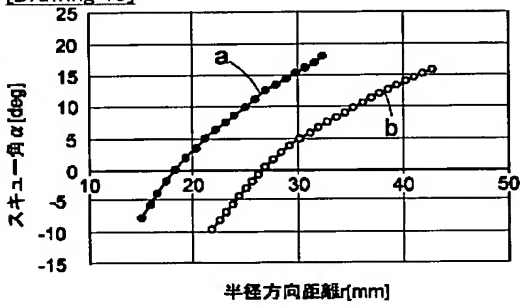


[Drawing 14]



[Drawing 15]



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